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(71) Applicant: Komag, Inc.
275 South Hillview Drive
Milpitas California 95035(US)

(72) Inventor: Yamashita, Tsutomu Tom
2822 Aqua Vista Drive
San Jose, CA 95132(US)
Inventor: Treves, David
479 Ferne Avenue
Palo Alto, CA 94306(US)
Inventor: Chen, Tu
18225 Gregory Place
Monte Sereno, 95030(US)
Inventor: Wickramasekara, Leelaratne
2770 Somerset Park Circle
San Jose, CA 95132(US)

(74) Representative: Schmidt-Evers, Jürgen, Dipl.-Ing. et al
Patentanwälte Mitscherlich & Partner,
Steinsdorfstrasse 10
W-8000 München 22(DE)

(54) Use of a quasi-amorphous or amorphous zirconia dielectric layer for optical or magneto-optic data storage media.

(57) A data storage device includes optical media or magneto-optic media. Formed on the optical or magneto-optic media is an amorphous or a substantially amorphous ZrO_2 layer (102; 204). The ZrO_2 layer is typically formed by sputtering, and includes an additive which renders the ZrO_2 either amorphous or substantially amorphous. Because of the amorphous or near amorphous nature of the ZrO_2 film (102, 204), noise is not introduced into a laser beam signal passing therethrough by crystal grain boundaries in the film (102, 204). In addition, because the film (102, 204) is substantially amorphous, birefringence will not generate noise in the laser passing therethrough caused by polymorphism in the film (102, 204).

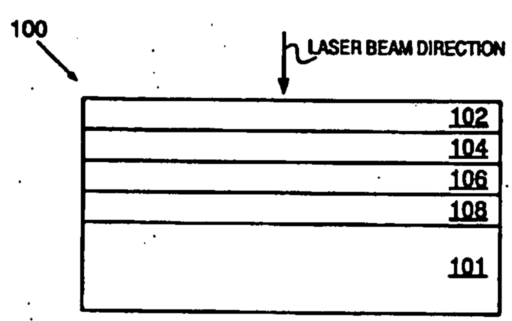

FIG. 4

EP 0 475 452 A2

BACKGROUND OF THE INVENTION

This invention pertains to thin film optical and magneto-optic memory media and more specifically to the incorporation of a quasi-amorphous or amorphous zirconia (ZrO_2) dielectric interference layer in an optical or magneto-optic data storage media.

Figure 1a illustrates a prior art optical data storage disk 1, which includes a substrate 2, a recording layer 3, and a dielectric layer 4. During recording of data in disk 1, a relatively high intensity laser beam 5 passes through dielectric layer 4, strikes and heats recording layer 3, thereby ablating a portion of recording layer 3 and forming a crater 6 therein (Fig. 1b). Recording layer 3 has a high index of refraction. In order to ensure that most of the energy from laser beam 5 is used to form crater 6, and is not reflected off of disk 1, dielectric layer 4 is provided, which has an index of refraction between the index of refraction of recording layer 3 and the index of refraction of air. Layer 4 has an optical thickness on the order of one tenth of the wavelength of laser beam 5. The purpose of dielectric layer 4 is to minimize reflection of light off disk 1, and makes it easier to record data in recording layer 3, using a lower power laser than that which would be required if layer 4 were absent. It is known to use ZrO_2, SiO, AlN, Si_3N_4 or SiO_2 for layer 4.

In other types of optical media, instead of forming craters such as crater 6, bumps such as bump 7 (Fig. 1c) are formed when laser beam 5 strikes recording layer 3.

When reading the data in disk 1, a relatively low power laser beam is caused to strike the surface of disk 1. If this low power laser beam strikes a portion of the disk where there is no crater or bump, the light from this beam is reflected by disk 1 and received by a photodetector. If this laser beam strikes a crater or bump, the laser beam is not simply reflected, but is scattered by the bump or crater. Thus, the amount of light received by the photodetector when the laser beam strikes the crater or bump will be different from the amount of light received when the laser beam reflects off a smooth portion of the disk. Thus, the presence of the crater or bump will be detected by the photodetector as a bit of digitally recorded information.

Other types of optical disks which use a laser to ablate a recording layer are discussed in U.S. Patent 4,461,807, issued to Mori et al. and incorporated herein by reference.

Another type of disk includes a recording layer whose crystal phase can change in response to application of a laser beam. Regions of the recording layer where the phase has been changed can be optically detected. An example of such a disk is described by Takeo Ohta et al. in "Million Cycle Overwritable Phase Change Optical Disk Media", SPIE Vol. 1078, Optical Data Storage Topical Meeting, 1989, pages 27-34, incorporated herein by reference. In Ohta's disk, the active layer is surrounded by dielectric layers (see Ohta Fig. 3).

The devices illustrated in Figures 1a to 1c, and the devices described by Mori and Ohta are herein referred to as optical disks.

Another type of data recording device is the magneto-optic disk. A simple structure embodying this type of device is magneto-optic disk 10, which includes a substrate 11, a magneto-optic alloy 12, and a dielectric layer 13 (see Fig. 2a). Disk 10 is erased by applying an external magnetic field 14a to disk 10, (or a combination of magnetic field 14a and the presence of a laser beam) thereby magnetizing disk 10 in the direction shown by arrows 15. Data may be recorded in alloy 12 with a high power laser beam 16, which raises the temperature of a portion 17 of alloy 12 high enough to lower the value of the magnetic coercive force. This permits the direction of magnetization of portion 17 to switch, as shown in Figure 2b, because of the effect of the magnetic field from the portion of alloy 12 directly adjacent portion 17. (In another type of magneto-optic disk, an external magnetic field 14b is applied to disk 10 during writing, while the laser beam strikes portion 17, to alter the magnetization direction of portion 17.)

Alloy 12 typically has a complex dielectric constant with a high imaginary component and a real component typically of about 3. Dielectric layer 13 has a relatively high dielectric constant (preferably about 2 or more) to minimize reflection of laser beam 16 off of disk 10 during writing. Layer 13 typically has a thickness on the order of one tenth of the laser wavelength.

During reading, a relatively low power laser beam (the read laser beam) strikes disk 10. If the read laser beam strikes portion 17 of disk 10, the portion of the read beam reflecting off portion 17 has its polarization angle rotated in a positive direction. (This rotation of the light polarization is known as "Kerr rotation".) However, if the low power beam reflects off a region of alloy 12 having a magnetization opposite that of portion 17, the light reflecting off this region has its polarization angle rotated in a negative direction. During reading, the presence of dielectric layer 13 increases the amount of rotation of the light reflected off disk 10. The effect of dielectric layer 13 on the angle of rotation of polarization is discussed by Chen et al. in "An Investigation of Amorphous Tb-Fe Thin Films For Magneto-Optic Memory Application," IEEE Transactions on Magnetics, Vol. Mag-16, No. 5, September 1980, pp. 1194-1196, incorporated herein by

reference.

Figure 3 illustrates another type of magneto-optic disk 30 including a dielectric layer 32, a magneto-optic alloy 33, a dielectric layer 34, a metal reflector layer 35, and a substrate 36. An example of such a disk is discussed by Chen et al. in "Optical Data Storage," SPIE, Vol. 382, January 17-20, 1983, pages 264-268, incorporated herein by reference. During reading, a portion 37a of a laser beam 37 reflects off alloy 33. A portion 37b of beam 37 passes through alloy 33 and dielectric layer 34, reflects off layer 35, and passes through layers 34, 33, and 32. Portion 37b of light emerging from disk 30 constructively interferes with portion 37a to produce a stronger magneto-optic effect.

Another type of magneto-optic disk is discussed in U.S. Patent 4,579,777, issued to Honguu et al., and incorporated herein by reference. Also see the article by E. Schultheiss et al. entitled "Production Technology for Magnetooptic Data Storage Media", published in Solid State Technology, March 1988, pages 106-112, incorporated herein by reference.

In each of the above-described types of data storage disks, one or more dielectric layers are used to facilitate writing to the disk, thus enhancing the signal-to-noise ratio exhibited by the disks. In addition, the dielectric layer provides protection against corrosion of the magneto-optic alloy or the recording layer.

Materials used as dielectric layers in optical disks or magneto-optic disks include SiO, SiO_2, Si_3N_4, AlN and ZrO_2. SiO_2 is amorphous, but has the disadvantage of a relatively low refractive index (e.g., about 1.4). SiO is also amorphous, and has the advantage of a higher refractive index (e.g., about 2.0), but it is difficult to control the amount of oxygen in an SiO film because SiO is not stoichiometrically stable compared to other oxide materials such as SiO_2. Thus, when attempting to sputter an SiO film, one usually forms an SiO_x film, in which x can vary, and thus the refractive index can also vary. Since dielectric film optical thicknesses must be controlled with great accuracy, such a variation in refractive indices is unacceptable compared with materials such as SiO. ZrO_2 has a high refractive index (about 2.0) and is stoichiometrically stable when sputtered from a ZrO_2 sputtering target compared to materials such as SiO. In other words, the oxygen content of a ZrO_2 film does not vary greatly as a function of sputtering conditions when sputtered from a ZrO_2 target. However, sputtered ZrO_2 is crystalline, as shown in U.S. Patent Application 07/138,997, filed by Chen et al. on December 29, 1987, assigned to the assignee of the present application and incorporated herein by reference. The crystal boundaries and rough interfaces of crystals in ZrO_2 can create noise in the laser signal during reading. Further, ZrO_2 can exhibit polymorphism (e.g., two or more types of phases of ZrO_2 in one film). This polymorphism can create a birefringence effect, and thus increase noise in an output signal.

SUMMARY OF THE INVENTION

In one embodiment of our invention, a ZrO_2 film is vacuum-deposited onto a magneto-optic recording medium. In another embodiment, the ZrO_2 film is vacuum-deposited onto an optical recording medium. In both of these embodiments, the ZrO_2 film includes an additive which causes the vacuum-deposited ZrO_2 to be amorphous or near-amorphous. (By near-amorphous, it is meant that the crystallites, if any, have a size less than or equal to about 10 Å.) The additive is typically a metal oxide which exhibits no solid solubility or miscibility in ZrO_2, or only a very limited solid solubility or miscibility in ZrO_2. In one embodiment, the additive is selected from the group consisting of Al_2O_3, SiO_2, BeO, WO_3, Ta_2O_5, V_2O_5 and PbO. Of importance, because this additive has only a limited solid solubility or miscibility, the additive constitutes a relatively small portion of the film and thus does not degrade the optical characteristics of the ZrO_2 film (e.g., the additive will not degrade the refractive index). In one embodiment, the additive constitutes less than 30% by weight of the film, and typically less than 20%.

The ZrO_2 film is typically sputtered and includes a stabilizer such as Y_2O_3, Lao, CaO, MgO, ThO_2, CeO_2, HfO_2, or Sc_2O_3. Other stabilizers can also be used. The addition of the stabilizer will also not degrade the refractive index appreciably from that of pure ZrO_2. The stabilizer tends to stabilize the ZrO_2 sputtering target in its high temperature cubic phase, thereby reducing the tendency of the sputtering target to crack due to phase transformation during sputtering. In one embodiment, the ZrO_2 sputtering target (and hence the resulting ZrO_2 film) comprises ten weight percent Al_2O_3 and five weight percent Y_2O_3.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1a, 1b, and 1c illustrate in cross section an optical disk constructed in accordance with the prior art.

Figures 2a and 2b illustrate in cross section a first type of prior art magneto-optic disk.

Figure 3 illustrates in cross section a second type of prior art magneto-optic disk.

Figure 4 illustrates in cross section a magneto-optic disk constructed in accordance with a first embodiment of the invention.

Figure 5 illustrates a magneto-optic alloy sput-

tered onto a crystalline underlayer.

Figure 6 illustrates a magneto-optic disk constructed in accordance with a second embodiment of the invention.

Figure 7 illustrates a magneto-optic disk constructed in accordance with a third embodiment of the invention.

Figure 8 illustrates a magneto-optic disk constructed in accordance with a fourth embodiment of the invention.

Figure 9 illustrates an optical disk constructed in accordance with a fifth embodiment of our invention.

Figure 10 is a phase diagram of ZrO_2-Al_2O_3, showing the low solid solubility of Al_2O_3 in ZrO_2.

Figure 11 is a phase diagram of ZrO_2-BeO showing the low solid solubility of BeO in ZrO_2.

DETAILED DESCRIPTION

Figure 4 illustrates a magneto-optic disk 100 constructed in accordance with a first embodiment of our invention. Disk 100 includes a glass substrate 101, a dielectric layer 102, a magneto-optic alloy layer 104, a dielectric layer 106, and a metal layer 108. Although in one embodiment, substrate 101 is glass, in another embodiment, other materials such as polycarbonate, acrylic or other polymer compounds are used. Metal layer 108 is provided to reflect laser light, and can be a material such as aluminum, copper, gold, silver or other metallic or non-metallic reflective materials.

Alloy layer 104 is typically a TbFe alloy including 26% Tb and 74% Fe, and is RF diode sputtered at a pressure of 20 milli-torr of argon and a power of 1 Kw using a target having an eight inch diameter. Alternatively, layer 104 may be DC magnetron or RF magnetron sputtered at 1 to 10 milli-torr and 1 Kw of power. However, other power densities, pressures, target geometries and sizes, and DC or RF magnetron or diode sputtering may also be used. In addition, other magneto-optic alloys and compositions such as TbFeCo, GdCo, GdFe, DbFe, DyFe, GdTbSe, TbDyFe, TeFe, HoFe, HoFeCo, HoCo, MnBi, MnSb, and CoPt can be used. The alloys listed in above incorporated U. S. Patent 4,579,777, issued to Honguu, and the alloys described in U.S. Patent 4,670,353, issued to Sakurai, incorporated herein by reference, may also be used. Alloy layer 104 is typically 20 to 100 nm thick.

In one embodiment, layers 102 and 106 include five weight percent Y_2O_3, ten weight percent Al_2O_3, with the remainder as ZrO_2. In another embodiment layers 102 and 106 contain 8% Y_2O_3 and 5% Al_2O_3. Sputtering layers 102 and 106 is typically accomplished using RF magnetron sputtering at a pressure of 4 milli-torr of argon and a power of 1 Kw, and an 8 inch diameter sputtering target. In other embodiments, RF diode sputtering can be used. Also, other pressures and power densities, target geometries and sizes can also be used. Layers 102 and 106 may be 50Å to several thousand angstroms thick, depending on the wavelength of the laser used to read or write data into alloy 104, and the other structures in the magnetic media. As mentioned above, the addition of Al_2O_3 reduces the crystal size in layers 102 and 106 and can render layers 102 and 106 amorphous or near-amorphous. This effect is described in greater detail in above-incorporated U.S. Patent Application 07/138,997, filed by Chen et al. on December 29, 1987. Of importance, the inclusion of Al_2O_3 in layers 102 and 106 enhances their ability to protect against corrosion. Also, because layers 102 and 106 are amorphous, there is no scattering of laser light by grain boundaries or rough interfaces between the ZrO_2 and adjacent layers created by crystalline ZrO_2 morphology as the laser light passes therethrough. In addition, there is no scattering of laser light by a birefringence effect caused by polymorphism in the ZrO_2 film.

Although in one embodiment, five weight percent Y_2O_3 and ten weight percent Al_2O_3 are used, other proportions of these materials may also be used. For example, the Y_2O_3 concentration can vary between two and fifteen percent and the Al_2O_3 concentration can vary between two and thirty percent.

As mentioned above, Y_2O_3 serves as a stabilizer which stabilizes the ZrO_2 sputtering target in its high temperature cubic phase, thereby reducing the tendency of the sputtering target to crack due to phase transformation during sputtering. Other stabilizers can also be used instead of Y_2O_3, e.g., LaO, CaO, MgO, ThO_2, CeO_2, HfO_2, Sc_2O_3, or other stabilizers. Also, as mentioned above, instead of using Al_2O_3, other additives can be provided which cause the ZrO_2 film to become amorphous or near-amorphous. Typically, such an additive is a metal oxide which exhibits no solid solubility or miscibility in bulk ZrO_2, or only a very limited solid solubility or miscibility in the ZrO_2. Materials such as SiO_2, BeO, WO_3, Ta_2O_5, V_2O_5, PbO or other metallic oxides can be used for this purpose.

Figure 10 is a phase diagram of Al_2O_3-ZrO_2. As can be seen Al_2O_3 exhibits minimal solid solubility in bulk ZrO_2. For example, at 1880°C (the temperature at which Al_2O_3 is most soluble in ZrO_2), if more than 6% Al_2O_3 is present in the ZrO_2 in bulk form, the Al_2O_3 comes out of solid solution. Below 1600°C, the phase diagram indicates about zero solid solubility of Al_2O_3 in ZrO_2. As discussed above, sputtering a thin film of ZrO_2 alloyed with Al_2O_3 yields an amorphous or substantially amorphous film.

Figure 11 is a phase diagram of BeO-ZrO_2. As can be seen, BeO similarly exhibits almost no solid solubility in ZrO_2.

Of importance, without the above-mentioned additive, under normal sputtering conditions, ZrO_2 will have a crystal size of about 100 to several thousand angstroms. However, in one embodiment of our invention, the additive reduces the crystal size below 50 Å, and typically to a size of 10 Å or less.

Layer 108 is a metallic or non-metallic reflective layer, and can be, for example, aluminum or gold, copper or silver in the range of 100Å to 10000Å. Although dielectric layers 102 and 106 and alloy layer 104 are typically formed by sputtering, these layers can be formed by other techniques as well, e.g., other vacuum deposition techniques such as thermal evaporation, electron beam plating or ion plating.

In a preferred embodiment, the structure of Figure 4 is formed by successively sputtering onto substrate 101, layers 108, 106, 104, and 102. Thus, alloy layer 104 is sputtered onto amorphous ZrO_2 layer 106. By providing a nucleation layer for alloy layer 104 which is amorphous, the properties of magneto-optic layer 104 are improved. One reason for this is that it is known that when a rare earth magneto-optic alloy is sputtered onto a surface, the magnetization direction is perpendicular to the surface that the magneto-optic alloy is deposited on. If instead of using amorphous or near-amorphous layer 106, one used a crystalline layer 110 (Fig. 5), layer 110 would be jagged, and magneto-optic layer 104 would include regions having magnetization directions 111 that were not generally perpendicular to the surface of the disk substrate. Thus, by providing an amorphous or near amorphous nucleation layer, magneto-optic alloy 104 is formed on a relatively flat surface, and thus the direction of magnetization is consistently perpendicular to disk 100 and will maximize polar Kerr rotation of the laser read back signal and not cause additional noise in the laser read back signal. Another advantage of this structure is that if the angle of magnetization is kept as perpendicular as possible to the disk surface, the return path of the magnetic flux is kept as short as possible, and as uniform as possible, thereby making the periphery of the magnetic domain as smooth as possible and hence making it easier to provide high density recording because of minimized domain size and minimized domain edge noise.

Another advantage of amorphous or near-amorphous ZrO_2 is that amorphous or near-amorphous ZrO_2 tends to retard corrosion of the magneto-optic alloy more effectively than crystalline ZrO_2.

Figure 6 illustrates another embodiment of our invention. The only difference between Figures 4 and 6 is that in Figure 6, layers 102, 104, 106 and 108 are sputtered onto substrate 101, in that order, while in Figure 4, layers 108, 106, 104 and 102 are sputtered onto substrate 101, in that order. Also, in Figure 6, the read and write laser beams must pass through substrate 101, whereas in Figure 4, the read and write laser beams do not pass through substrate 101.

An optional layer 109 is shown in phantom in Fig. 6. Layer 109 may be acrylic, amorphous or near-amorphous ZrO_2, or other material for protecting layer 104 (e.g. against corrosion). Layer 109 may also be an adhesive layer for adhering the structure of Figure 6 to a second structure (identical to Figure 6) for double-sided optical recording.

In one embodiment, substrate 101 can have a spiral groove formed therein by photomasking and etching, having a depth of 600 to 700 Å and a pitch of about 1.5 μ. In the case of substrates made of polymers such as polycarbonate, grooves may be formed by injection molding with a pre-grooved mold. The spiral groove formed in substrate 101 is part of a means for formatting the disk known in the art as "ISO format".

Although in the embodiment of Figures 4 and 6 layer 104 is magneto-optic film, in another embodiment of our invention, layer 104 is a film whose morphology changes in response to laser light (instead of having its magnetization direction change). For example, in one such embodiment, a crystalline recording layer could become amorphous in response to a laser beam or vice versa. In another such embodiment, the laser causes the crystal phase of the material to change. Regions of morphology change in such an embodiment can be optically detected with a read laser beam. Materials which can be used for layer 104 in such an embodiment are discussed by the above-incorporated Ohta article, and include GeTe-Sb_2Te_3-Sb alloys. Other materials include amorphous Se and As. Figure 7 illustrates a third embodiment of our invention. In Figure 7, substrate 101, dielectric layer 102, magneto-optic alloy layer 104, dielectric layer 106 and metallic layer 108 perform the same function as described above. In addition, substrate 101', dielectric layer 102', magneto-optic alloy layer 104', dielectric layer 106' and metallic layer 108' function in the same manner as corresponding layers 101-108. A binder layer 112, which can be epoxy or another adhesive, binds the component portions of disk 100' together. In this way, a two-sided magneto-optic disk is provided. Data can be independently recorded in magneto-optic alloy layers 104 and 104' using laser beams striking opposite sides of the disk through substrates 101 and 101' respectively.

Figure 8 illustrates a magneto-optic disk 200

including a substrate 201a, a first protective layer 207 (a very thin metal film), a second protective layer 202 (typically a dielectric film), and a magneto-optic recording layer 203. Also included is a spacer layer 204, an aluminum reflective film 205, an adhesive layer 206, and a second substrate 201b. This structure is similar to that described by the above-incorporated Honguu patent. (Layers 201a, 207, 202, 203, 204, 205, 206 and 201b correspond to Honguu layers 1a, 7, 2, 3, 4, 5, 6 and 1b, respectively. See Honguu Fig. 2.) However, instead of using the material suggested by Honguu for dielectric layer 202 and spacer layer 204, amorphous or near-amorphous ZrO_2 is used.

Other embodiments of our invention are similar to the structures disclosed in Figures 1a, 1b, 1c, 2a, 2b and 3, described above, except instead of using prior art dielectric materials in these structures, amorphous or near-amorphous ZrO_2 including the above-mentioned additive is used. In such embodiments, the substrate may be glass, acrylic, polycarbonate or other appropriate material. For the case of the embodiment of Figures 2a, 2b and 3, the magneto-optic alloy can be any of the previously mentioned magneto-optic alloys. The various layers in these structures may be vacuum deposited, e.g. by sputtering, ion plating, evaporation or other techniques.

For the case of the embodiment of Figures 1a-1c, the recording layer may be a material such as tellurium (Te) about 100 to 2000Å thick. The recording layer may also be one of the recording layer materials listed in the above-incorporated Mori patent. The substrate may be glass or plastic. In one embodiment, recording layer 3 is applied to substrate 1 by sputtering or another deposition technique, and amorphous or near amorphous ZrO_2 is sputtered onto layer 3.

Although Figures 1a, 1b and 1c illustrate a dielectric film formed on an optical recording media, in another embodiment, an amorphous or substantially amorphous ZrO_2 layer 250 is deposited onto a substrate 251, and the optical recording layer 252 is deposited onto the amorphous or substantially amorphous ZrO_2 250 (Figure 9). In such an embodiment, during reading and writing, laser light is passed through the substrate and the ZrO_2 film prior to striking the recording media. An optional additional amorphous or near-amorphous ZrO_2 layer 253 may be formed on recording layer 252 for corrosion protection.

In the above-described embodiments involving sputtering of ZrO_2, ZrO_2 is sputtered from a sputtering target including ZrO_2, a stabilizer, and the additive which causes the ZrO_2 to be amorphous. However, ZrO_2 can also be sputtered using reactive sputtering. In such an embodiment, the target would include zirconium and aluminum, and would be sputtered in the presence of oxygen, which would oxidize the zirconium and aluminum during sputtering to form ZrO_2 and Al_2O_3.

While the invention has been described with respect to specific embodiments, those skilled in the art will appreciate that changes may be made in form and detail without departing from the spirit and scope of the invention. For example, a variety of deposition techniques may be used to form the various layers of a data storage disk. In addition, materials other than those listed may be used as an active layer for a data storage disk. The amorphous or near-amorphous ZrO_2 dielectric layer may have thicknesses other than on the order of one tenth the laser wavelength. Other thicknesses may also be appropriate, depending on other parameters of memory design. Other layers may also be incorporated into a data storage device, e.g. to facilitate adhesion of the various structures within the device. Accordingly, all such changes come within the scope of our invention.

Claims

1. A structure comprising a substrate (101) and a layer of magneto-optic media (104) formed on said substrate (101), said structure further characterized by comprising an amorphous or near amorphous film (102) comprising ZrO_2 formed on said magneto-optic media (104).

2. Structure of claim 1, further characterized in that said film (102) also comprises a stabilizer.

3. Structure of claim 1, further characterized in that said film (102) includes a metal oxide which exhibits very little or no solid solubility in ZrO_2.

4. Structure of claim 3, further characterized in that said metal oxide is selected from the group consisting of Al_2O_3, SiO_2, BeO, WO_3, Ta_2O_5, V_2O_5 and PbO.

5. Structure of anyone of claims 1 to 4, further characterized in that said film (102) is sputtered onto said media.

6. Structure of anyone of claims 1 to 5, further characterized in that said media (104) comprises a rare earth-transition metal alloy having an amorphous structure, and which exhibits a magneto-optic effect and has an easy magnetization direction normal to the plane of the magneto-optic media.

7. Structure of claim 6, further characterized in that said media comprises an alloy selected

from the group of alloys consisting of GdCo, GdFe, DbFe, DyFe, GdTbSe, TbDyFe, TeFe, TbFeCo, HoFe, HoFeCo.

8. Structure of anyone of claims 1 to 4, further characterized in that said media (104) comprises a crystal line magneto-optic material selected from the group consisting of MnBi, MnSb and CoPt.

9. A structure including a magneto-optic layer (104) and a substrate (101), said structure further characterized by comprising:
an amorphous or near amorphous film (106) comprising ZrO_2 formed on said substrate (101), said magneto-optic layer (104) being formed on said film (106).

10. Structure of claim 9, further characterized by comprising an amorphous or near amorphous film (102) comprising ZrO_2 formed on said magneto-optic layer (104).

11. An optical data storage device comprising a substrate (201a) and an optical recording layer (203) formed on said substrate, said optical data storage device further characterized by comprising:
an amorphous or near amorphous ZrO_2 layer (204) formed on said optical recording layer (203).

12. An optical data storage device comprising a substrate (201b), said data storage device further characterized by comprising:
an amorphous or near amorphous ZrO_2 layer (204) formed on said substrate (201b); and
an optical recording layer (203) formed on said amorphous or near amorphous ZrO_2 layer (204).

13. Optical data storage device of claim 11 or 12, further characterized in that data is recorded in said optical recording layer (203) by a laser which forms a crater in said optical recording layer (203).

14. Optical data storage device of claim 11 or 12, further characterized in that data is recorded in said optical recording layer by a laser which forms a bump in said optical recording layer (203).

15. Optical data storage device of claim 11 or 12, further characterized in that data is recorded in said optical recording layer (203) by a laser which alters the morphology of the optical recording layer.

16. Optical data storage device of claim 15, further characterized in that said optical recording layer (203) comprises a material selected from the group consisting of Se and As.

17. A method for forming a data recording device comprising the step of providing a structure (100) including a layer of magneto-optic media on a substrate (101), said method further characterized by including the step of depositing an amorphous or near amorphous layer (102) comprising ZrO_2 onto said magneto-optic media (104).

18. Method of claim 17, further characterized in that said step of depositing comprises a step of sputtering an amorphous or near amorphous layer (102) comprising ZrO_2 onto said magneto-optic media (104).

19. Method comprising the step of providing a substrate (101), said method further characterized by comprising steps of:
depositing an amorphous or near amorphous layer (106) comprising ZrO_2 onto said substrate (101); and
depositing a magneto-optic film (104) onto said amorphous or near amorphous layer (106).

20. Method of claim 19, further characterized by comprising the step of depositing an amorphous or near amorphous layer (102) comprising ZrO_2 onto said magneto-optic film (104).

21. Method of claim 19 or 20, further characterized in that said step of depositing said amorphous or near amorphous layer (102; 106) comprises the step of sputtering said amorphous or near amorphous layer (102; 106).

22. Method comprising the step of providing a structure (200) comprising a layer of optical recording media (203) formed on a substrate (201a), said method further characterized by comprising the step of:
depositing an amorphous or near amorphous layer (204) comprising ZrO_2 onto said optical recording media (203).

23. Method of claim 22, further characterized in that said step of depositing said amorphous or near amorphous layer comprises the step of sputtering said amorphous or near amorphous layer (204).

24. Method comprising the step of providing a substrate (201b), said method further characterized by comprising the steps of:

depositing an amorphous or near amorphous layer (204) comprising ZrO_2 onto said substrate (201b); and

depositing an optical recording layer (203) onto said amorphous or near amorphous layer (204).

25. Method of claim 24, further characterized by comprising the step of sputtering an amorphous or near amorphous layer (204) comprising ZrO_2 onto said optical recording layer (203).

26. Structure of anyone of claims 1 to 25, further characterized in that said amorphous or near amorphous film (102; 106) comprises more than about 65% ZrO_2, a stabilizer, and a metal oxide exhibiting very little or no solid solubility in bulk ZrO_2, said metal oxide comprising less than about 30% of said amorphous or near amorphous film.

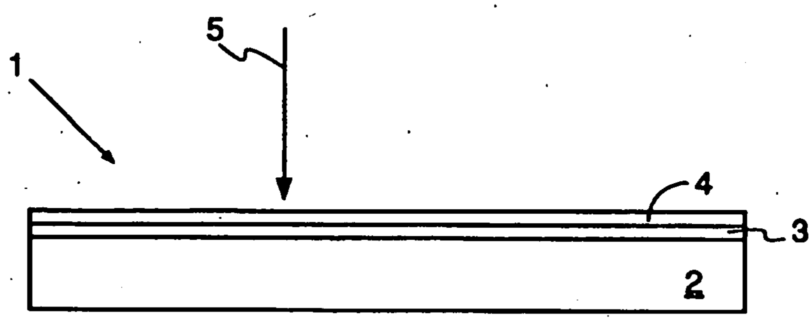

FIG. 1a
(PRIOR ART)

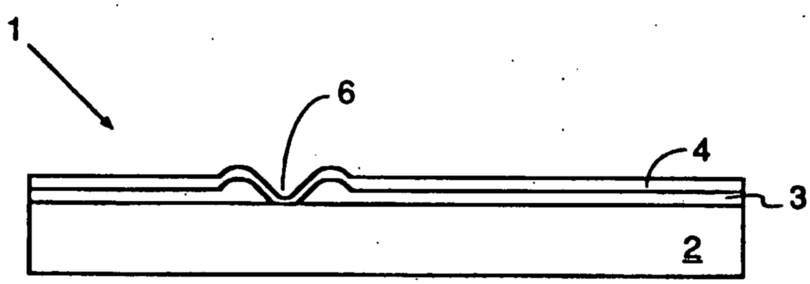

FIG. 1b
(PRIOR ART)

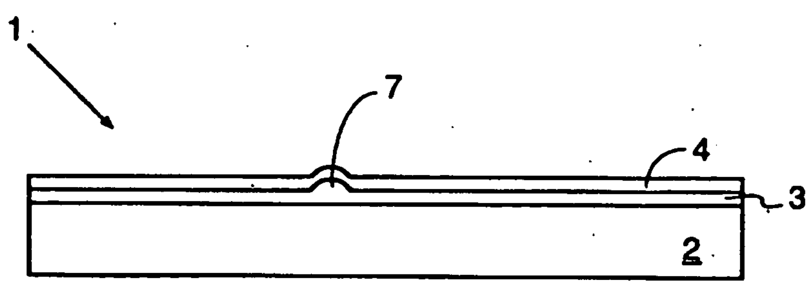

FIG. 1c
(PRIOR ART)

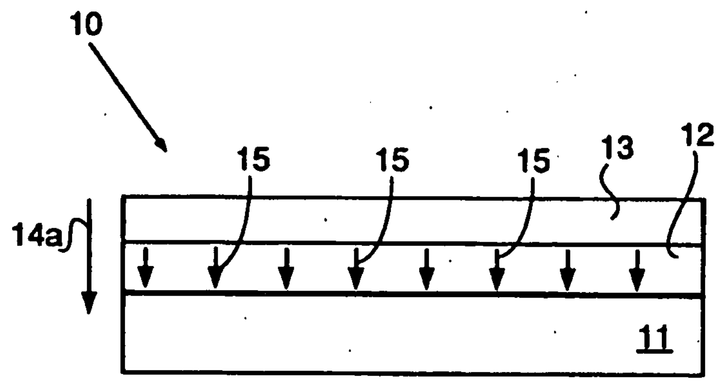

FIG. 2a
(PRIOR ART)

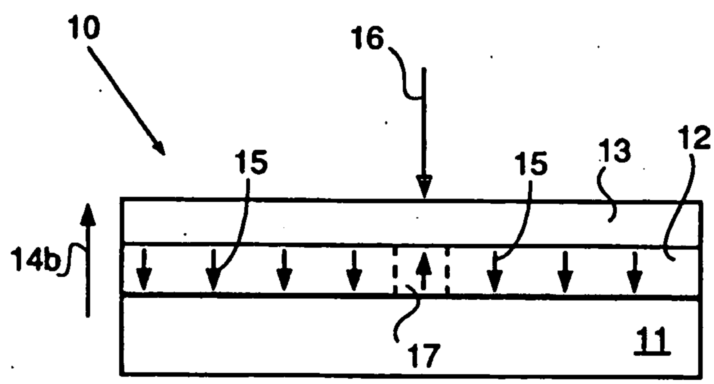

FIG. 2b
(PRIOR ART)

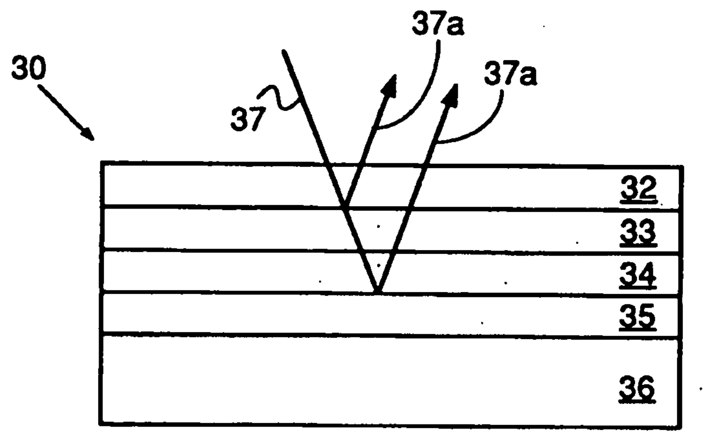

FIG. 3
(PRIOR ART)

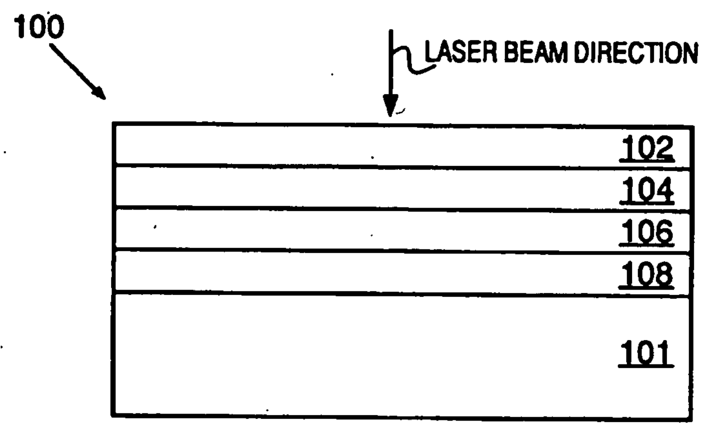

FIG. 4

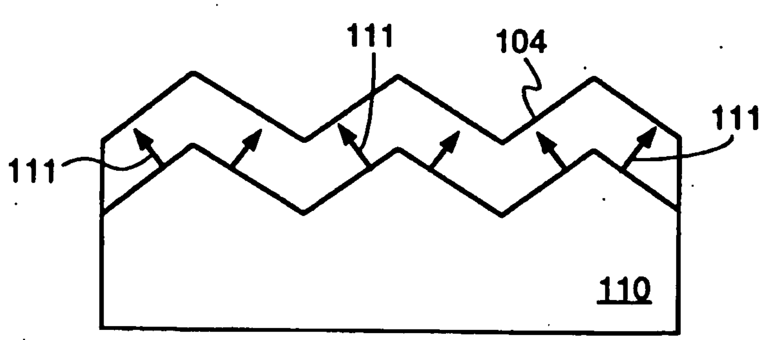

FIG. 5

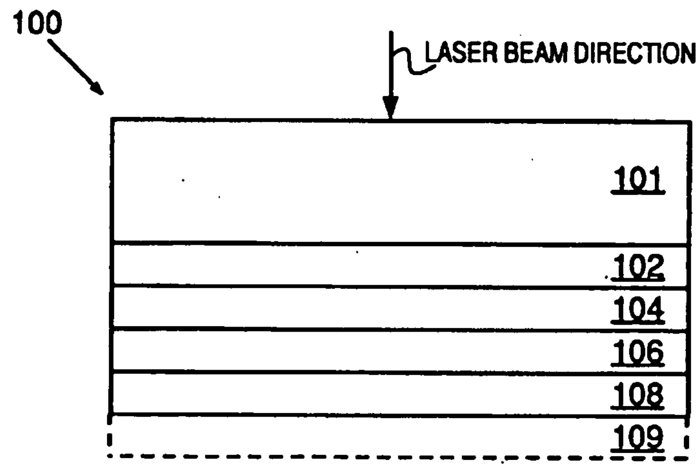
100
LASER BEAM DIRECTION
101
102
104
106
108
109

FIG. 6

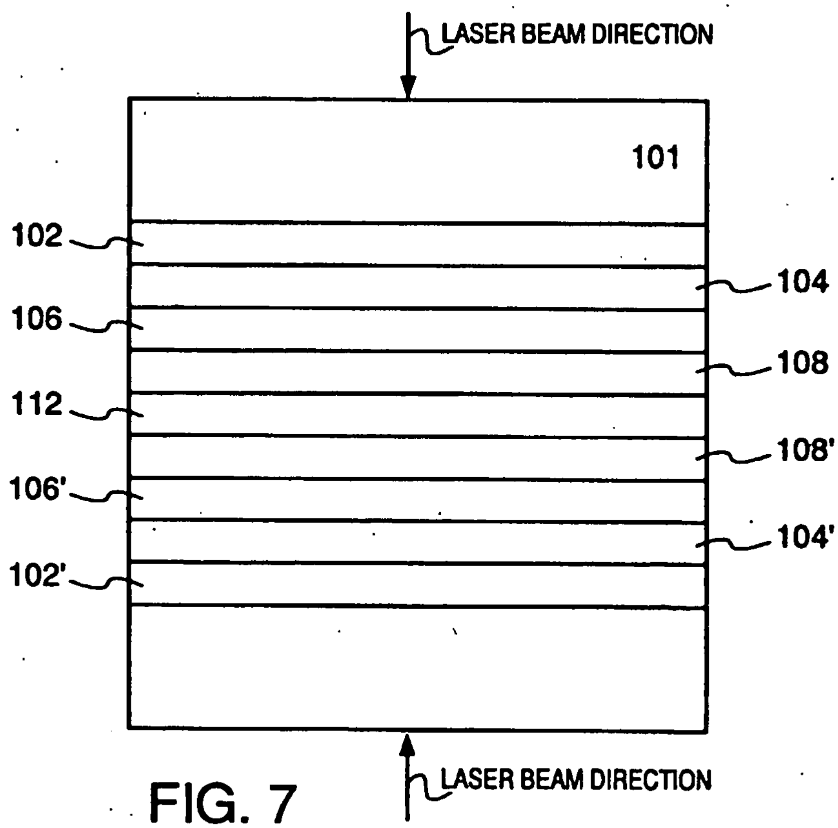
LASER BEAM DIRECTION
101
102
104
106
108
112
108'
106'
104'
102'
LASER BEAM DIRECTION

FIG. 7

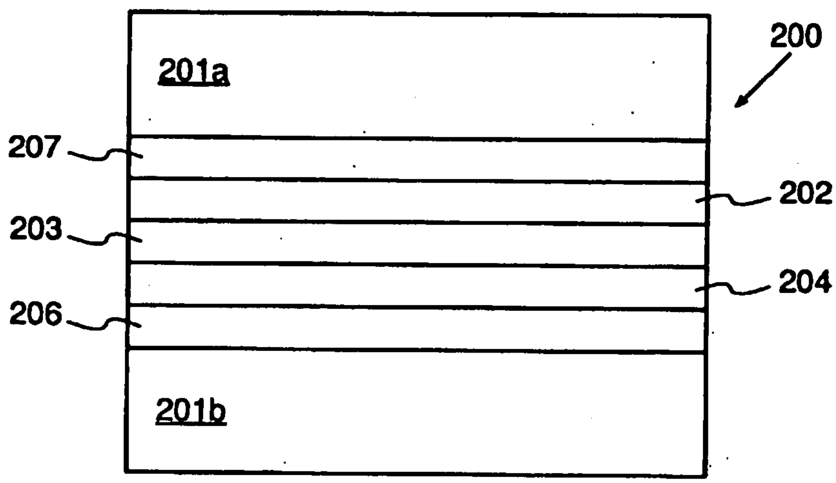

FIG. 8

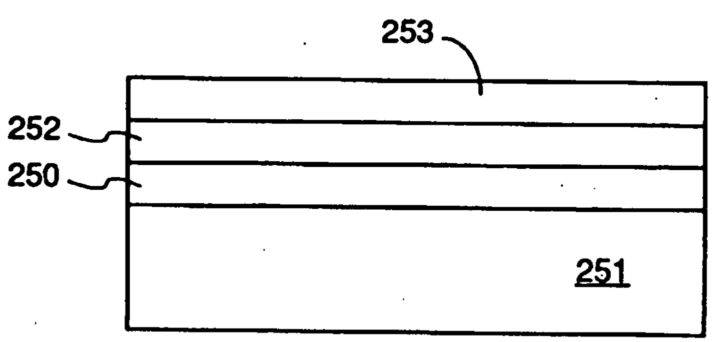

FIG. 9

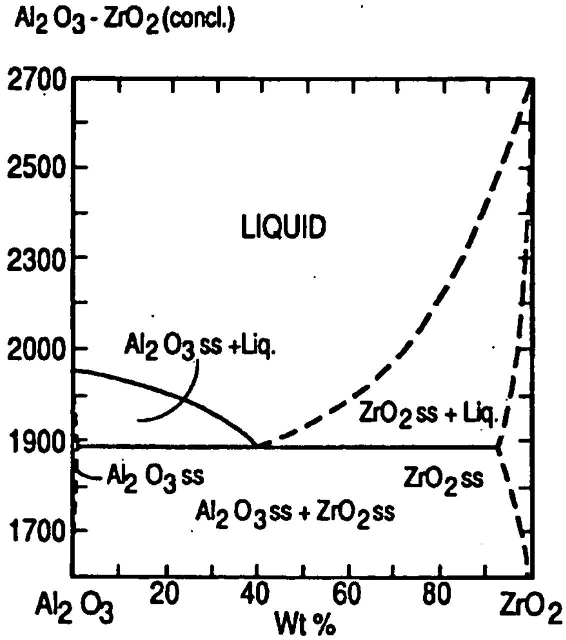
Al2 O3 - ZrO2 (concl.)
2700
2500
2300
2000
1900
1700
LIQUID
Al2 O3 ss +Liq.
ZrO2 ss + Liq.
Al2 O3 ss
ZrO2 ss
Al2 O3 ss + ZrO2 ss
Al2 O3
20
40
60
80
ZrO2
Wt %

FIG. 10

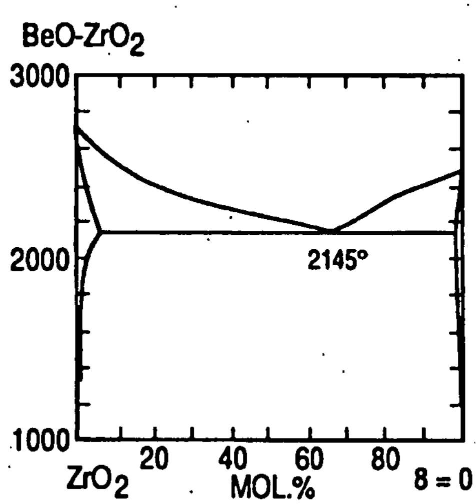
BeO-ZrO2
3000
2000
1000
2145°
ZrO2
20
40
60
80
8 = 0
MOL.%

FIG. 11